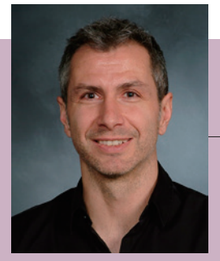

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Please replace [at sign] with @.

Research Interests

Membrane protein, Structure, Conformational changes, Atomic Force Microscopy, Force Spectroscopy

Education Professional Career

1997- 2001	PhD thesis: Summa cum laude, Biozentrum, University Basel, Switzerland
2001 - 2003	Postdocs: University Basel, Switzerland (2001), Institut Curie, Paris, France (2002, 2003)
2004 - 2007	CR2 INSERM – Researcher, Institut Curie, Paris, France
2001 - 2005	Habilitation (HDR), Université Pierre et Marie Curie, Paris 6, Jussieu, Paris, France
2007 - 2012	DR2 INSERM – Junior Research Director
2010 - 2011	Director INSERM U1006, Institut Curie, Paris, France
2012 - 2016	DR1 INSERM – Senior Research Director, INSERM
2012 - 2016	Director INSERM U1006, INSERM/Aix-Marseille Université, Marseille, France
2017- present	Professor, Weill Cornell Medicine, Anesthesiology, Physiology & Biophysics, NY, USA

Scientific Activities

1995 - present	Atomic Force Microscopy application and development

Honors

2019 - 2024	NIH Director's Pioneer Award (DP1)
2012 - 2017	ERC Starting/Consolidator Grant 2012
2006 - 2010	INSERM Avenir 2005 Program Awardee

Publications

1. Millisecond dynamics of an unlabeled amino acid transporter, Nature Communications, 2020, 11(5016), doi.org/10.1038/s41467-020-18811-z, TR Matin#, GR Heath#, GHM Huysmans, O Boudker & S Scheuring

2. Force-induced conformational changes in Piezo1, Nature, 2019, 573(7773):230–234, doi. 10.1038/s41586-019-1499-2, Y-C Lin#, YR Guo#, A Miyagi, J Levring, R MacKinnon* & S Scheuring

3. High-Speed AFM Height Spectroscopy (HS-AFM-HS): Microsecond dynamics of unlabeled biomolecules, Nature Communications, 2018, 9(1):4983. doi:10.1038/s41467-018-07512-3, GR Heath & S Scheuring

High-Speed Atomic Force Microscopy: A Forceful Tool for Molecular Biophysics

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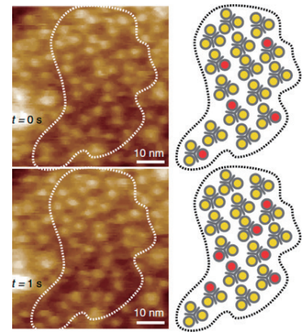
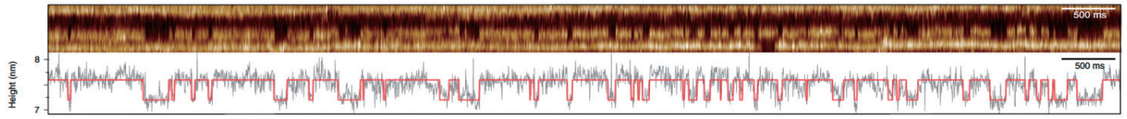
High-speed atomic force microscopy (HS-AFM)[1] is a powerful technique that provides dynamic movies of biomolecules at work. HS-AFM has the notable advantage that it permits to subject the proteins under investigation to environmental cues such as changes of pH, ions, ligands, temperature, light and force. This is particularly advantageous for the study of ion channels that respond to a wide range of stimuli [2], and transporters with substrate-dependent activities. To break current temporal limitations to characterize molecular dynamics using HS-AFM, we use HS-AFM line scanning (HS-AFM-LS) and HS-AFM height spectroscopy (HS-AFM-HS), a technique whereby we oscillate the HS-AFM tip at a fixed position and detect the motions of the molecules under the tip [3]. These methods allowed us to determine the dynamics of individual unlabeled amino acid transporters at millisecond temporal resolution [4].



HS-AFM frames and schematic of amino acid transporter GltPh in membrane.



Top: HS-AFM line scanning kymograph with 3.3ms temporal resolution of GltPh transport motion.
Bottom: Height/time trace and idealized state assignment (red).

References

[1] A high-speed atomic force microscope for studying biological macromolecules, PNAS, 2001, 98(22):12468-12472, doi.org/10.1073/pnas.211400898, Toshio Ando, Noriyuki Kodera, Eisuke Takai, Daisuke Maruyama, Kiwamu Saito, and Akitoshi Toda

[2] Force-induced conformational changes in Piezo1, Nature, 2019, 573(7773):230–234, doi. 10.1038/s41586-019-1499-2, Yi-Chih Lin, Yusong R Guo, Atsushi Miyagi, Jesper Levring, Roderick MacKinnon & Simon Scheuring

[3] High-Speed AFM Height Spectroscopy (HS-AFM-HS): Microsecond dynamics of unlabeled biomolecules, Nature Communications, 2018, 9(1):4983. doi:10.1038/s41467-018-07512-3, George Heath & Simon Scheuring

[4] Millisecond dynamics of an unlabeled amino acid transporter, Nature Communications, 2020, 11(5016), doi.org/10.1038/s41467-020-18811-z, Tina R Matin, George R Heath, Gerard HM Huysmans, Olga Boudker & Simon Scheuring